GCE Biology BY4

Mark Scheme – January 2013

Question			Marking details	Marks Available
1	*(a)*	(i)	Photoperiod(ism)	1
		(ii)	Phytochrome NOT PR/ PFR	1
		(iii)	Leaves	1
	(b)	(i)	Ammonium/ NH_4^+ + nitrate (ions)/ NO_3^- [both needed for 1 mark] NOT ammonia	1
		(ii)	Denitrification	1
		(iii)	*Azotobacter*	1
			Question 1 total	**6**

Question			Marking details	Marks Available
2	*(a)*		Gram positive: purple/ violet NOT crystal violet Gram negative: red / pink [both needed for 1 mark];	1
	(b)		<u>Gram +ve</u>: (thick) {murein / peptidoglycan} cell wall (only)/ no lipopolysaccharide layer; {retains/ binds/ absorbs} crystal violet stain / purple colour; <u>Gram –ve</u>: {lipoprotein / lipopolysaccharide}{ layer / wall} (external to murein cell wall); Does not retain {crystal violet stain / purple colour}; Stains {red/pink} with {counter stain / safranin / carbol fuchsin};	3 max 2 if only discuss one type of bacteria
	(c)	(i)	Ignore references to Gram +ve / Gram –ve.	
			A bacillus/ bacilli; NOT rod	1
			B spirillum/ spirilli; NOT spiral	1
			C coccus/ cocci; NOT round / staphylococcus	1
		(ii)	(lipoprotein / lipopolysaccharide layer) protects against (some) {antibiotics) / penicillin / antibodies} / makes them less susceptible to attack by lysozyme/ (lipid component) acts as an (endo)toxin;	1

Question		Marking details		Marks Available
(d)	(i)	*Plate U*	*- enough colonies for reliable results/* *- colonies easily countable;* *NOT the right number/ we can see them*	*max 2*
		Plate R/S	*- cannot distinguish individual colonies;*	
		Plate T	*- too many colonies to count reliably;*	
		Plate V	*- not enough colonies for reliable estimate*	
	(ii)	69 colonies x 10 000 (dilution factor) x 2 (or 1/0.5); 1 380 000/ 1.38 x 10^6 colonies per cm^3;		2
	(iii)	does not include {dead / non-viable bacteria}/ cannot be sure that {each colony has grown from a single bacterium/ colonies are not clumped}/ ORA;		1
	(iv)	need to count pathogenic bacteria / pathogenic bacteria more likely to grow at temperature close to body temperature/ want bacteria to grow quickly to identify to treat infection as quickly as possible; NOT want to grow them as quickly as possible without qualification		1
		Question 2 total		**[14]**

Question			Marking details	Marks Available
3	*(a)*	(i)	{maximum number / density/ size} of a population; Sustained/ maintained (indefinitely) by a particular environment/ OWTTE;	2
		(ii)	24 to 26;	1
		(iii)	**I.** **Density Dependent** nutrient / food / yeast levels; oxygen level / concentration; disease/ infection/ contamination; toxins / waste products; accept pH NOT mates	max 2
			II. **Density Independent** temperature; size of container; accept pH if not awarded in **I**	max 1
	(b)	(i)	competition for (same) food source/ niche; reject nutrients *P.aurelia* {more successful than/ outcompetes} *P.caudatum;*	2
		(ii)	Live in different locations in same habitat/ *P. caudatum* swims freely while *P. bursaria* lives at bottom of ponds/ *P. caudatum* feeds (on yeast suspended) in water while *P. bursaria* feeds (on yeast that have settled) at the bottom; Less interspecific competition;	2
			Question 3 Total	**[10]**

Question		Marking details	Marks Available
4	*(a)*		

Chloroplasts	Mitochondria
D;	H;
A;	F;
B;	J;
E;	G;

8

(b) (i) Reference to a suitable function of ATP e.g. protein synthesis/ active transport/ muscle contraction etc NOT movement

Different types of energy can be transferred into a common form;

Only 1 molecule needed to transfer energy to chemical reactions;

Energy can be supplied in {small amounts/ packages/ approx 30.6kJ} /less {energy/ heat} wasted;

Easily transported (across membranes);

{Single enzyme/ only ATPase} needed to release energy from ATP;

{Single bond needed to be broken/ one step reaction} to release energy;

max 3

(ii) used by all organisms/ species; NOT cells

To provide {energy/ fuel} for (nearly all biochemical) reactions;

NOT provide energy unqualified

2

Question 4 Total **[13]**

Question			Marking details	Marks Available
5	*(a)*	(i)	**A** + 40mV **C** - 70mV [both needed for 1 mark] (accept suitable alternatives eg., -60 / + 30)	1
		(ii)	**depolarisation** Sodium / Na^+ (ion) channels open; Na^+ {flood / diffuse rapidly} into axon; (pd) inside axon becomes {positive/ +40}; **repolarisation** Na^+ (ion) channels close and K^+(ion) channels open; K^+ {flood / diffuse rapidly} out of axon ; Must infer sudden movement out (pd) inside axon becomes {negative/ returns to-70};	max 2 max 2
		(iii)	threshold potential not reached / all sub-threshold stimuli; stimulus / depolarisation not enough to open Na^+ (ion) channels; ref. to action potential being 'All or Nothing';	max 2
	(b)	(i)	{2 or more/ a number of/ several} polypeptide chains; NOT group {bonded/ joined} together; NOT held Reject if used 'wrong' bond – i.e. hydrogen (alone)/ glycosidic/ ester/ peptide to form functional protein/ OWTTE;	max 2
		(ii)	H 	1
		(iii)	middle of cell membrane is composed of {lipid / fatty acid side chains / tails}/ non polar;	1

Question		Marking details	Marks Available
(c)	(i)	Myelin; Accept phosphopilid	1
	(ii)	Schwann cell;	1
	(iii)	Accept annotation on diagram myelin inhibits{loss of charge/ movement of ions} (from axon) / insulates (axon)/ prevemts depolarisation; {gaps/ spaces} (between Schwann cells) called nodes of Ranvier; no myelin present in {nodes/ gaps/ spaces}; depolarisation only possible at Nodes of Ranvier / action potential can only form {at the nodes/ where there is no myelin}/ channels can only {open/close} in the nodes; action potential jumps from one node to the next / saltatory conduction/ lengthens local circuits/ OWTTE; nerve impulse transmission faster;	max 4
		Question 5 Total	**[17]**

Question			Marking details			Marks Available
6	*(a)*	(i)	Glycolysis	cytoplasm;		3
			Link reaction	matrix (of mitochondria);		
			Krebs Cycle	matrix (of mitochondria);		
			[1 mark each row]			
		(ii)	Glycolysis;			1
	(b)	(i)	Carbon dioxide/ CO_2;			1
		(ii)	Decarboxylase;			1
	(c)		Substrate- level phosphorylation		2; and 6;	4
			Glycerol can be converted to a 3C sugar which enters respiration at this point		3;	
			ATP is used in phosphorylation		1;	
			Question 6 Total			**[10]**

Question		Marking details	Marks Available
7	*(a)*	Describe how **the light-independent** stage of photosynthesis (Calvin cycle) leads to the production of triose phosphate. [7] Indicate the origin of the raw materials required for this stage of photosynthesis and the possible uses of the triose phosphate produced. [3]	
	A	In stroma (of chloroplast);	
	B	5 carbon compound;	
	C	ribulose bisphosphate / RuBP;	
	D	carbon dioxide <u>fixed/ fixation</u>;	
	E	By enzyme RuBisco;	
	F	To form hexose bisphosphate / 6C compound;	
	G	(breaks down into 2 × 3C) glycerate 3 phosphate/PGA/GP;	
	H	(converted into 2 × 3C) triose phosphate/TP/GALP;	
	I	NADPH H^+/reduced NADP / $NADPH_2$;	
	J	supplies hydrogen/used for reduction;	
	K	ATP broken down into ADP and Pi supplies energy. [Max 7] (not ATP supplies energy).	
	L	ATP + $NADPH_2$ from <u>light dependent stage</u>,	
	M	CO_2 from {environment/respiration}	
	N	RuBP regenerated from TP.	
	O	Phosphate from ATP needed for this.	
	P	TP starting point for synthesis of: glucose, lipids, amino acids, chlorophyll, cellulose, starch etc. Any **2** products. [max 3]	
		Question 7(a) Total	**[10]**

Question		Marking details	Marks Available
7	*(b)*	Give an account of how the kidney is involved in osmoregulation in mammals. [10]	
	A	Antidiuretic hormone; NOT abbreviated	
	B	(ADH) Is {secreted/ released} by the (posterior lobe of the) pituitary;	
	C	(ADH) is carried in the bloodstream to the (distal convoluted tubule and) collecting duct;	
	D	When the blood is more concentrated / low Ψ/ more negative/ low blood volume;	
	E	Detected by (osmo) receptors in hypothalamus;	
	F	(more) ADH released;	
	G	ADH levels increases the permeability of the (cells lining the) DCT/CD to water /explanation of water channels opening / aquaporins inserted into DCT membrane.;	
	H	Water moves out of the DCT/CD by osmosis;	
	I	Into the {interstitial / tissue} fluid where it is rapidly removed by the capillary network/ vasa recta;	
	J	This occurs because the {medulla of the kidney/ tissue fluid} has a high {solute/ salt/ ion} concentration/low Ψ;	
	K	Due to the countercurrent multiplier system operating in the Loop of Henle/ correct reference of how counter current produced;	
	L	This (conserves water and) produces {small volumes/ concentrated urine};	
	M	Most water absorbed in the PCT;	
	N	Length of loop of Henle effects the volume of urine produced	
	O	Short loop of Hemle results in less water reabsorbed/ ORA	
	P	Correct ref to adaptation to their environment	
			[max 10]
		Question 7b Total	**[10]**